TEMPERATURES OF HEATED VS UNHEATED PLATES

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Bristol Stickney and I did many tests with 11" x 11" 9.5 watt electric heating pads placed behind 12" x 12" 1/8" aluminum plates. We always tested identical twin plates, one with power and the other not. We started with black plates but later painted them white to reduce temperature rise in the sun. These 12" x 12" plates had 32.4 BTU's per hour to get rid of. Of course they grew warmer than a twin, faced the same way with no power. During the night a heated side typically ran 20° warmer than an unheated side. From this I calculate that a typical U valve for a wall at night is
32.4/20°F BTU per hour = 1.6 BTU/°F per hour per square foot.

The same heat to a horizontal surface usually raises the temperature only about 15° giving a U value of 32.4 BTU per hour /15°F = 2.16 BTU/°F per square foot per hour.

Some of our graphs show windy times when the heated twin comes closer to the unheated as wind sweeps heat away.

A great surprise is to find that during clear dry nights the heated horizontal plate temperature does not rise as high as ambient air temperature. Night radiation to the sky can excede 9.5 watts per square foot.

The experiments with the 9.5 watt per square foot panels where we deduce U values of 1.6 and 2.16 might lead you to expect a 1000 watt per M^2, sun, 93 watts per square foot, to raise temperature = .9 x 93 x 3.413/2.16 = 132°F above ambient but I have never seen such a large temperature rise with black point. Heat flows more readily as the flux increases, and also as temperatures rise. We should test the same panels with 100-watt heaters to show that the Δt is never 10 times that of the 10-watt panel but always less.

We are making a set of 100 watt, 10 watt, no watt 12" x 12" plates for the meeting.